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Introduction to Robotics

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1. **Assessment of Systematic Body and Control of Stepper Machine that Creates Motion, Direct Current Machine that creates Motion and Servo Machine that creates Motion**
   * 1. **Stepper Machine that Creates Motion:**
     2. **Systematic Body:** Stepper machine that creates motion are relating to machines powered by electrical tools that change the function from representing data as numbers changes or repeating change in magnitude into machine operated rotating rod in machine turning motion. They can be made up of several series of loops (stages of development) that are active in a series to yield increase in degree of turning motion. These degrees are characteristically 1.8 units per degree (200 degree per geologic change) in filled to capacity – degree form.
     3. **Control:** Stepper machine that creates motion function by activating the loop in an order with fixed purpose by the request development of turning motion and degree figure. They can be managed using while allowing access to inside closed circuit when operating a machine or denying access to inside closed circuit when operating a confidential machine. While allowing access to inside closed circuit management, the repeating change causes the magnitude to go to the machine that creates motion determines it location, but there’s no return of output to prove that it arrives at the request location. While denying access to inside closed circuit operation, return of output tool like convert text to code are used to make certain correct locating by slightly changing the control means of communication based on the real location of the machine that creates motion.
2. **Direct Current Machine that Creates Motion:**
3. **Systematic Body:** Directcurrent machine function on the basic assumption electromagnetism. They can be made up of stationary part around which rotor turns (immobile component) with piece of metal that attracts metal and a rotating part of machine (rotating part) with loop of strand of metal. When a current is passed through the loops, a magnetized region of space, which communicates with the magnetized region of space of the stationary part around which rotor turns, causing the rotating part of machine to turn around axis.
4. **Control:** Directcurrent machine function In two principal arrangements of parts: finished with soft and fuzzy surface and brushless. Finished with soft and fuzzy surface Directcurrent machine tool with bristles attached to handle and a control for electric current flow that suddenly change the development of current in the rotating part of machine loops as it turn around axis, maintaining the magnetized region of space and causing uninterrupted turning motion.

Brushless Directcurrent machine use valves, transistors, or silicon chips as controlling devices to change the current in the stationary part around which rotor turns loops, getting rid of the need for tool with bristles attached to handle and control for electric current flow. Directcurrent machine can be managed using repeating change in magnitude width self-contained interchangeable unit to change rate of movement and development of turning motion.

1. **Servo Machine that creates Motion**
2. **Systematic Body:** Servo motorsarerotating part of an actuator that gives exact control sharply defined location. They contain a Direct Current motor, fixed transmission setting, return of output tool (usually a instrument for measuring electromotive force or convert text to code) to provide self – adjusting controlled system control machine part of location and speed.
3. **Control:** Servo motors function by examining the similarities of the real location of the return of output with the request location and slightly changing the control means of communication (usually a PWM means of communication) to the motor accordingly. This self-adjusting controlled system control mechanism ensures correct locating and makes servo motor a perfect example for application requiring exact act of movement control, such as design and use of robots, Computer numerical control (CNC) machines and automation systems.
4. **Details of the problem – solving procedure for controlling Servo Motors, DC Motors and Stepper Motors.**
5. **Servo Motors:**

**Algorithm:** Servo motors are characteristically controlled using a procedure called Pulse Width Modulation (PWM). The algorithm involves the following steps:

1. **Initialization**: Set up the PWM variable quantity determining outcome such as rate of occurrence and obligation complete process.
2. **Position Setting**: Determine the requested location for the servo motor rotating rod in machine.
3. **Conversion**: Change the requested location into an appropriate PWM signal. Usually, this involves making of maps of the requested location to a precise allocated task repeated sequence of events within the PWM signal variety.
4. **Output**: Communicate the PWM signal to the servo motor.
5. **Feedback (not compulsory):** If the way of proceeding requires closed-loop control, uninterruptedly view the real location of the servo motor using a return of output tool (e.g. instrument for measuring electromotive force, or encoder). Slightly change the PWM signal based on the feedback to remove errors from any failure to match between the requested and real locations.
6. **Direct Current Motors:**

**Problem-solving computer program (Open-Loop Control):** In open-loop control, the problem-solving procedure involves the following steps:

1. **Initialization**: Set up the motor variable quantity determining outcome such as electric potential, current, and development.
2. **Rate of movement / Location of Operational Level of Device:** Determine the requested rate of movement or location for the motor.
3. **Feedback Reading**: Uninterruptedly read the uninterrupted rate of movement or location of the motor from the detecting instrument.
4. **Unintentional Mistake Estimation**: Calculate the distinguishing feature between the requested and real rate of movement or location.
5. **Control Signal Adjustment**: Adjust the control signal (e.g., PWM) practical to the motor based on the Unintentional Mistake Estimation to minimize the error.
6. **Output**: Send the adjusted control signal to the motor.
7. **Stepper Motors:**

**Problem-solving computer program (Open-Loop Control):** In open-loop control, the problem-solving computer program involves the following steps:

1. **Initialization**: Set up the motor variable quantity determining outcome such as step mode (full-step, half-step, micro stepping), rate of movement, and development.
2. **Step Generation**: Generate a series of representing data as numbers repeating change in magnitudes to activate the motor loops in the requested series and development.
3. **Timing**: Control the timing between changes or repeating change in magnitude to achieve the desired rate of movement.
4. **Output**: Send the pulse series to the stepper motor driver.

**Problem-solving computer program (Closed-Loop Control):** Closed-loop control for stepper motors is to smaller degree shared but can be implemented using feedback mechanisms similar to those used for servo motors. The algorithm would involve reading the real location of the motor using encoders or other location detecting instruments and adjusting the pulse series accordingly to achieve precise positioning.

1. **Study of Situation where Servo Motor, DC Motor and Stepper Motor is used in a Robotics Task.**
2. **Servo Motor study of situation: Design and use of robots Arm Control:**

**Task Summary:** A design and use of Robots Company develops a robotic arm for industrial replacement of human workers by technology jobs assigned to somebody such as pick-and-place operations in manufacturing skills.

**Motor Deployment**: Servo motors are used to actuate the places where parts are joined of the robotic arm due to their exact control over sharply defined location.

**Study of Situation Details:**

1. **Relevance**: The robotic arm is deployed in the assembly line process in a factory setting to become automatic. It needs to pick up objects of assorted shapes and sizes from one location and correctly place them in another location.
2. **Servo Motor Control**: Each place where parts are joined of the robotic arm is equipped with a servo motor. The location of each servo motor conforms to a precise angle of rotation, allowing the arm to move with precision.
3. **Algorithm Tool**: The control algorithm for the servo motors merges feedback from encoders fixed in place on each place where parts are joined this feedback ensures that the arm reaches the requested location correctly and adjusts for any changes caused by external factors.
4. **Consequence**: The robotic arm supports exact and repeatable movements, improving the competence of the assembly line process. The use of servo motors enables the arm to handle a wide range of objects with varying heaviness and outlines likely to be accurate.
5. **Direct Current Motor study of situation: Mobile Robot science of navigating:**

**Task Summary**: An organized study team develops a self-governing mobile robot for indoor navigation and environmental monitoring in storage buildings.

**Motor Deployment**: DC motors are used to drive the wheels of the mobile robot, providing the necessary driving force and skilled movement.

**Study of Situation Details:**

1. **Relevance**: The mobile robot is created to find route through disorganized messy environments autonomously, avoiding obstacles and reaching designated significant points on journey for data collection.
2. **Direct Current Motor Control**: Two Direct Current motors are fixed in place on the robot main frame, each driving a set of wheels. By controlling the rate of movement and development of turning motion of each motor not controlled by another, the robot can move forward, backward, turn, and navigate around hindrances.
3. **Algorithm Tool**: The control algorithm for the Direct Current motors uses feedback from wheel encoders to roughly calculate the robot's location and rate of change in position. This feedback is used in conjunction with algorithms for obstacle detection and path planning to navigate the robot safely to its predetermined end of trip.
4. **Consequence**: The mobile robot successfully navigates through complicated environments, collecting data and performing monitoring tasks with very small human intervention. The use of Direct Current motors provides the robot with robust propulsion and nimble maneuvering capabilities.
5. **Stepper Motor Case Study: 3D Printer Machine Part:**

**Task Summary**: A newly formed company develops a desktop 3D printer for swift full-size functional model and small-scale manufacturing applications.

**Motor Deployment**: Stepper motors are employed to drive the X, Y, and Z-axis movement of the 3D printer's print head and build standard operating system.

**Study of Situation Details:**

1. **Relevance**: The 3D printer utilizes additive manufacturing technology to create three-dimensional objects layer by layer from digital designs. Precise control over the movement of the print head and build standard operating system is necessary for achieving accurate print results.
2. **Stepper Motor Control**: Stepper motors are used to drive the straight line motion of the print head along the X and Y axes and the vertical motion of the build standard operating system along the Z-axis. The motors are controlled using open-loop control algorithms that generate precise step series to move the print head and standard operating system to the requested locations.
3. **Algorithm Tool:** The control software of the 3D printer converts the code from digital design into a series of movement commands for the stepper motors. These commands specify the number of steps and direction of rotation for each motor, allowing for precise positioning of the print head during the printing process.
4. **Consequence**: The 3D printer produces high-quality prints with fine details and dimensional accuracy. The uses of stepper motors enables precise control over the movement of the print head and build standard operating system, allowing for the creation of complex geometries and complex and difficult designs.